

PATENT ABSTRACTS OF JAPAN

(11)Publication number : 2001-006653

(43)Date of publication of application : 12.01.2001

(51)Int.Cl.

H01M 2/26
H01M 10/40

(21)Application number : 11-179672

(71)Applicant : NEC CORP

(22)Date of filing : 25.06.1999

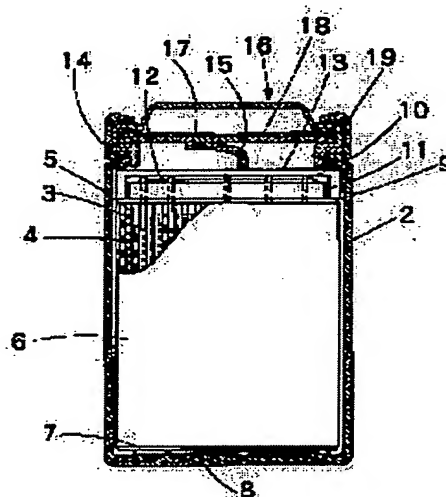
(72)Inventor : KITAMI TAKESHI
ZAMA KOICHI

(54) NON-AQUEOUS ELECTROLYTE SECONDARY BATTERY

(57)Abstract:

PROBLEM TO BE SOLVED: To simplify the manufacture of battery having a high-rate discharge characteristics with less IR loss by improving the collector structure of a cylindrical battery.

SOLUTION: A positive electrode 3 and a negative electrode 4 are laminated with a separator 5 interposed and wound round to form a battery element 6, and an electrode tab consolidating member 11 is provided on at least one side in the neighbourhood of the end face of this battery element 6, and in the condition that a plurality of electrode tabs 8 and 9 connected with either of the positive electrode and a negative electrode collector extending from the end face of the battery element 6 are in contact with the electroconductive surface of the tab consolidating member 11, an electrode tab fastening member 12 is fitted to the consolidating member 11 or a constituent member of the consolidating member 11 is deformed, and thereby the electrode tabs are attached fast to the member 11 without welding, and also the member 11 or 12 is joined with the outer connecting terminal of the battery through leads. Thus an intended non-aqueous electrolyte secondary battery is completed.



LEGAL STATUS

[Date of request for examination] 25.05.2000

[Date of sending the examiner's decision of rejection] 12.09.2003

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

[Claim(s)]

[Claim 1] It is. the nonaqueous electrolyte rechargeable battery which held the cell element which wound what the positive-electrode charge collector and the negative-electrode charge collector were alike, respectively, formed the positive-active-material layer and the negative-electrode active material layer, and carried out the laminating through the separator in the cell can -- An electrode tab unification member is prepared at least in one side near the end face of a cell element. Where the conductive side of an electrode tab unification member is touched, two or more electrode tabs of the positive-electrode charge collector prolonged from the end face of a cell element or a negative-electrode charge collector connected to either at least While fitting an electrode tab fixing member into an electrode tab unification member, or deforming the configuration member of an electrode tab unification member and fixing an electrode tab to an electrode tab unification member The nonaqueous electrolyte rechargeable battery characterized by joining the external connection terminal of a cell to an electrode tab unification member or an electrode tab fixing member with a conductive connection lead.

[Claim 2] The nonaqueous electrolyte rechargeable battery according to claim 1 which an electrode tab unification member is the taper-like tubular object which has the contact surface with an electrode tab inside, and is characterized by holding the electrode tab which deformed by the heights which the crevice is formed in the inner surface of a taper-like tubular object, and were prepared in the fixing member by the crevice.

[Claim 3] The nonaqueous electrolyte rechargeable battery according to claim 1 characterized by arranging an electrode tab, making a plate-like object transform, and fixing between the plate-like objects which are plate-like objects which the electrode tab unification member combined with the shaft, and has countered and arranged, and have been arranged face to face.

[Claim 4] The nonaqueous electrolyte rechargeable battery according to claim 3 characterized by the thing of the crevice or heights which transforms and holds an electrode tab to the contact surface with the electrode tab of a plate-like object for which either is formed at least.

[Detailed Description of the Invention]

[0001]

[Industrial Application] This invention relates to the nonaqueous electrolyte rechargeable battery in which especially high charge and discharge are possible about the rechargeable battery which used nonaqueous electrolyte.

[0002]

[Description of the Prior Art] The nonaqueous electrolyte rechargeable battery represented by the rechargeable lithium-ion battery using a dope, the negative electrode which can be dedoped, and the positive electrode containing transition-metals oxide a lithium [whether that of what carried out the laminating of the band-like negative electrode which applied the negative-electrode active material to the band-like negative-electrode side charge collector, and the band-like positive electrode which applied positive active material to the band-like positive-electrode side charge collector through the separator is covered with a sheathing material, and] Or after producing the cell element which winds spirally these things that carried out the laminating, and is called a cylinder-like jelly roll, holding in a cell can and considering as a cell is performed.

[0003] Since it is cylindrical, it has the description that it is possible not to call at the part of a layered product but to perform a uniform cell reaction, the cylindrical cell occupies the important location also in the nonaqueous electrolyte rechargeable battery use in order to take out a high current, and especially the cell that held the cylinder-like cell element in the cell can is expect also as a large-sized cell for the power an electric vehicle, for electric auxiliary bicycles, etc., while excel in sealing nature.

[0004] Drawing 7 is a sectional view explaining the conventional cylindrical cell. The cell element 56 which wound what carried out the laminating of the band-like positive electrode 54 with which the cylindrical cell 51 prepared positive active material in the band-like negative electrode 53 which prepared the negative-electrode active material in the negative-electrode side charge collector in the cell can 52, and the positive-electrode side charge collector through the separator 55 with bigger width of face than a band-like negative electrode and a band-like positive electrode is formed, and a positive electrode or a negative electrode does not project in the ends side of a cell element, but is constituted from an edge of a separator. In the case of the cell which made the cell can 52 the negative-electrode side edge child, the strip-of-paper-like negative-electrode lateral electrode tab 57 attached in the band-like negative electrode is joined to the wall of a cell can by approaches, such as welding. Moreover, the positive-electrode lateral electrode tab 58 is connected to the cell header 59 which

served as the positive-electrode side edge child with the pressure open valve which opens an internal pressure at the time of the unusual pressure buildup inside a cell.

[0005] However, in such a cell, since a strip-of-paper-like electrode tab could not become long, and loss in the electrode tab section could not become large and two or more electrode leads could not be arranged, loss of the current between electrode tabs became uneven, there was a problem that some electrode tabs generated heat with an energization current, and there was a problem that high rate discharge was impossible.

[0006]

[Problem(s) to be Solved by the Invention] Then, in order to reduce IR loss by high rate discharge, the shoulder section which spread greatly is prepared in the end face of the winding object of the cell element inside a cell can, and the cylindrical cell which has improved IR loss by the ejection of a small number of electric conduction rib is proposed in JP,10-83805,A by picking out many electric conduction ribs from the band-like charge collector of a winding object, and connecting.

[0007] However, the thing which can improve IR loss by using two or more electric conduction ribs in such a cell, As if the description of the nonaqueous electrolyte rechargeable battery of it being necessary on a cell element to prepare the shoulder section for connecting an electric conduction rib in a cell can, and the invalid volume inside a cell can increasing, and having a big capacity consistency will be reduced, both The process which welds many electric conduction ribs to the shoulder section prepared in the end face of a cell element needs much activity manday, and becomes what has like [complicated] an erector. This invention makes it a technical problem to offer the nonaqueous electrolyte rechargeable battery with an easy assembly with a large capacity consistency to which IR loss by the electrode tab between the cell element at the time of high rate discharge, a cell can, or a cell lid was reduced.

[0008]

[Means for Solving the Problem] It is. the nonaqueous electrolyte rechargeable battery which held the cell element which wound what the positive-electrode charge collector and the negative-electrode charge collector boiled this invention, respectively, formed the positive-active-material layer and the negative-electrode active material layer, and carried out the laminating through the separator in the cell can -- An electrode tab unification member is prepared at least in one side near the end face of a cell element. Where the conductive side of an electrode tab unification member is touched, two or more electrode tabs of the positive-electrode charge collector prolonged from the end face of a cell element or a negative-electrode charge collector connected to either at least While fitting an electrode tab fixing member into an electrode tab unification member,

or deforming the configuration member of an electrode tab unification member and fixing an electrode tab to an electrode tab unification member. It is the nonaqueous electrolyte rechargeable battery which joined the external connection terminal of a cell to the electrode tab unification member or the electrode tab fixing member with a conductive connection lead.

[0009] An electrode tab unification member is the taper-like tubular object which has the contact surface with an electrode tab inside, and the crevice is formed in the inner surface of a taper-like tubular object, and it is the aforementioned nonaqueous electrolyte rechargeable battery which holds the electrode tab which deformed by the heights prepared in the fixing member by the crevice. It is the plate-like object which the electrode tab unification member combined with the shaft, and has countered and arranged, and is the aforementioned nonaqueous electrolyte rechargeable battery which arranges an electrode tab, is made to transform a plate-like object, and is fixed between the plate-like objects arranged face to face. It is the aforementioned nonaqueous electrolyte rechargeable battery of the crevice or heights which transforms and holds an electrode tab to the contact surface with the electrode tab of a plate-like object with which either is formed at least.

[0010]

[Embodiment of the Invention] This invention prepares an electrode tab unification member at least in one side near the end face of the cell element which would what carried out the laminating of a band-like positive-electrode electrode and a band-like band-like negative-electrode electrode through the separator, contacts two or more electrode tabs linked to the positive-electrode charge collector prolonged from the end face of a cell element, and a negative-electrode charge collector in the electric-conduction contact surface of an electrode tab unification member, and is fixed and fixed by the fixing member which fitted into the electrode tab unification member. And the process which loss in the electrode tab section can be reduced since an electrode tab can be shortened by this, and two or more electrode tab length can be arranged, and loss between electrode tabs can equalize, and can prevent partial generation of heat by the current, and welds two or more electrode tabs is made unnecessary, and simplification is made possible like an erector.

[0011] Below, this invention is explained with reference to a drawing. Drawing 1 is a sectional view explaining one example of the cell of this invention. The nonaqueous electrolyte rechargeable battery 1 of this invention has held the cell element 6 which would what carried out the laminating of the positive-electrode electrode 3 in which the positive-active-material layer was formed on the positive-electrode charge collector, and

the negative-electrode electrode 4 in which the negative-electrode active material layer was formed on the negative-electrode charge collector, through the separator 5 in the cell can 2 interior. The negative-electrode side electric insulating plate 7 is formed in the end face of the pars basilaris ossis occipitalis of the cell element 6, two or more negative-electrode electrode tabs 8 attached in the edge of a negative-electrode charge collector are prolonged from opening of a negative-electrode side electric insulating plate, and two or more of those negative-electrode electrode tabs are joined by the inner surface of the cell can 2.

[0012] Moreover, two or more positive-electrode electrode tabs 10 which the positive-electrode side electric insulating plate 9 prepared, and were attached in the edge of the positive-electrode charge collector of a **** cage and a cell element are being fixed to the end face of the upper part of the cell element 6 by the fixing member 12 which fitted into the interior of the electrode tab unification member 11, where it extended from opening prepared in the positive-electrode side electric insulating plate and the inner surface of the electrode tab unification member 11 is contacted. The insulating lid 13 is attached in the upper part of the electrode tab unification member 11, the level difference section 14 formed by recessing of the cell can 2 was fixed, and the insulating lid 13 has prevented the migration inside the cell can of the cell element 6. Moreover, the electric conduction lead 15 is connected to the electrode tab unification member 11, it is joined to the conductive connection section 17 of the cell header 16 which served as the external connection terminal, and conductive connection is formed. The member which replaces with metal members, such as band-like, as an electric conduction lead, and has elasticity may be used, and since a cell element can be held with a spring between cell headers by using the member which has elasticity, it becomes possible to ease the impact added from the outside to a cell.

[0013] The pressure disconnection plate 18 which operates at the time of lifting of the internal pressure by the abnormalities inside a cell, the component which intercepts an excessive current may be prepared in the cell header 16. Moreover, the cell header 16 has obturated the cell by closing the upper part of the cell can 2 through the gasket 19 attached in the level difference section 14 of the cell can 2.

[0014] Drawing 2 is drawing explaining one example which unifies the electrode tab by the electrode tab unification member, and is fixed. Drawing 2 (A) shows a perspective view and drawing 2 (B) is a sectional view explaining the condition of having attached. It is in the condition to which the curved surface of the shape of a bigger taper than a lower path is formed, and two or more positive-electrode electrode tabs 10 contacted the inner surface, the fixing member 12 is pressed fit in the interior of the electrode tab

unification member 11 from the upper part, fitting of the upside path is carried out to an electrode tab unification member, and, as for the electrode tab unification member 11, the positive-electrode electrode tab 10 is fixed, as for an inner surface. In addition, in a drawing, although the positive-electrode tab illustrated only two pieces, the number of positive-electrode electrode tabs can use the number of arbitration according to the electrode surface product of a cell element etc.

[0015] Two or more crevices 20 are formed in the inner surface of the electrode tab unification member 11, and the positive-electrode electric conduction tab 10 transformed by the heights 21 prepared in the front face of the fixing member 12 pressed fit from the upper part is held in a crevice 20, and let conductive connection be a more positive thing. Moreover, heights can be smoothly inserted by making an electrode tab unification member and a fixing member into a taper-like curved surface, respectively. As for a crevice and heights, it is desirable to consider as the configuration of multiple coning which cut the crowning, semi-sphere side type, etc., and to enlarge both contact surface. Moreover, heights could prepare plurality crosswise [of the contact surface with the electrode tab unification member of a fixing member], and in the example shown in drawing, they have prepared it in the whole peripheral surface while forming at a time crosswise [three]. By preparing irregularity all over a peripheral surface, a positive-electrode electrode tab is combinable with an electrode tab unification member in the location of arbitration irrespective of the location of the positive-electrode electrode tab taken out by the end face of a winding object.

[0016] Moreover, to the fixing member 12, it can prevent that the fixing member pressed fit moves to the upper part by forming the omission prevention projection 22. As for the omission prevention projection 22, it is desirable to prepare three or more places on a periphery. Moreover, since the process which joins an electric conduction lead by producing an electric conduction lead to one becomes unnecessary and a production process decreases in case the electric conduction lead 15 which connects the conductive connection section of an electrode tab unification member and a cell header to the electrode tab unification member 11 may be attached beforehand and produces the electrode tab unification member 11, it is desirable.

[0017] Drawing 3 is drawing explaining other examples which unify the electrode tab by the electrode tab unification member, and are fixed. Drawing 3 R> 3 (A) shows a perspective view, and drawing 3 (B) is a sectional view explaining the condition of having attached. Drawing 3 is drawing showing the electrode tab unification member 11 which held spacing with the shaft 24 and combined the plate-like electric conduction contact-carrying member 23, inserts two or more positive-electrode electrode tabs 10 in

the space between the plate-like electric conduction contact-carrying members 23 in the direction of an arrow head, and unifies the electrode tab unification member 11 and the positive-electrode electrode tab 10 by applying and crushing thrust 25 from both sides of a plate-like electric conduction contact-carrying member.

[0018] In one side of the contact surface with the positive-electrode electrode tab of the plate-like electric conduction contact-carrying member 23 In the contact surface of the plate-like electric conduction contact-carrying member of another side which two or more crevices 20 are formed and counters Two or more heights 21 are formed. It fixes certainly, without falling out from the electrode tab unification member 11, since the positive-electrode electrode tab 10 deforms with the concavo-convex configuration of an up-and-down plate-like electric conduction contact-carrying member and irregularity is formed in both sides of an electrode lead tab, in case the up-and-down plate-like electric conduction contact-carrying member 23 is crushed by press. In addition, in a drawing, although the positive-electrode tab illustrated only two pieces, the number of positive-electrode electrode tabs can use the number of arbitration with the capacity of a cell etc. Moreover, the electric conduction lead 15 which connects the conductive connection section of a cell header conductively to an electrode tab unification member may be beforehand attached in the electrode tab unification member 11.

[0019] Drawing 4 is drawing explaining other examples which unify the electrode tab by the electrode tab unification member, and are fixed. Drawing 4 R> 4 (A) shows a perspective view, and drawing 4 (B) is a sectional view explaining the condition of having attached. The electrode tab unification member 11 consists of disc-like members with opening 26 inside, it is in the condition to which two or more positive-electrode electrode tabs 10 contacted the inner surface in the electric conduction contact surface of opening 26, and the fixing member 12 in which the crevice which agreed in the diameter of the electrode tab unification member 11 inside from the upper part was formed is pressed fit from the upper part, fitting is carried out to the electrode tab unification member 11, and the positive-electrode electrode tab 10 is fixed. In addition, in a drawing, although the positive-electrode tab illustrated only two pieces, the number of positive-electrode electrode tabs can be set to arbitration with the capacity of a cell etc. Moreover, the partition member 27 is formed in the electrode tab unification member 11, two or more partitions are formed in the opening 26 of the electrode tab unification member 11 at it, and a position can be easily defined for the installation location of the positive-electrode electrode tab 10 by the partition member 27.

[0020] Two or more heights 21 are formed in the outside surface of the electrode tab unification member 11, and the positive-electrode electrode tab 10 is held between a

crevice 20 and heights 21 between the crevices 20 established in the inner surface of the fixing member 12 pressed fit from the upper part, and let conductive connection be a more positive thing. Moreover, two or more openings are prepared in the fixing member 12 by the same partition member 28 as what was prepared in the electrode tab unification member 11. After forming the omission prevention piece 29 in the fixing member 12 furthermore and fixing an electrode tab unification member for a fixing member, omission of a fixing member can be prevented by bending the omission prevention piece 29. As for an omission prevention piece, it is desirable to prepare three or more places on a periphery. Moreover, the electric conduction lead 15 which connects the conductive connection section of a cell header conductively to an electrode tab unification member may be beforehand attached in the electrode tab fixing member 12.

[0021] If it is desirable to use a stable metal in the environment inside the cell at the time of charge and discharge as for the electrode tab unification member of this invention and it is in a positive-electrode side, aluminum, titanium, and its alloy are used. Moreover, in the formed concavo-convex section, it is desirable to use a member with a big degree of hardness so that the aluminium foil material used as a positive-electrode electrode tab may be transformed certainly and can be held. Similarly, when an electrode tab unification member is used for a negative-electrode side, a member with a big degree of hardness is used so that the nickel foil which nickel and its alloy, stainless steel, etc. are used, and is used as a negative-electrode electrode tab can fix certainly with the irregularity formed at the time of fixing.

[0022] Moreover, although an electrode tab unification member can define the magnitude etc. suitably according to the operating current of a cell, it is set on the cell which performs the charge and discharge of 100A at the maximum, for example, and an electrode tab unification member is the cross section of the current passage section 3mm 2 The cell which prevented excessive generation of heat etc. and was stabilized can be obtained by considering as the above. Moreover, the electric conduction lead which connects with external connection terminals, such as a cell header, from an electrode tab unification member is 2 3mm similarly. It is desirable to have the above cross-sectional area, and the sum total area of the contact section with an electrode tab unification member, a positive-electrode electrode tab, or a negative-electrode electrode tab is also 2 3mm. Considering as the above is desirable.

[0023] The positive-electrode electrode and negative-electrode electrode which are used for the cell of this invention are explained. Drawing 5 is drawing explaining an example of the cell element of this invention, drawing 5 (A) is the top view which developed the positive-electrode electrode and the negative-electrode electrode, and drawing 5 (B) is

drawing showing some cross sections in the condition of having wound. The positive-electrode electrode tab 10 is joined to the part in which the positive-electrode electrode 3 forms the positive-active-material layer 32 on the positive-electrode charge collector 31, and the positive-active-material layer of the edge of the positive-electrode charge collector 31 is not formed. The negative-electrode electrode tab 8 is joined to the part by which the negative-electrode active material layer 42 is formed by the negative-electrode electrode 4, and the negative-electrode active material layer 42 of the edge of the negative-electrode charge collector 41 is not formed on the negative-electrode charge collector 41 at it. Moreover, since one electrode is continuing, the productivity of an electrode spreading process is high, the positive-electrode electrode or negative-electrode electrode shown in drawing 5 does not receive a limit of the width of face of the electrode tab attached in an electrode, and a connecting location, but the alignment of the electrode tab at the time of winding is also easy for it.

[0024] Drawing 6 is drawing explaining other examples of the cell element of this invention, drawing 6 (A) is the top view which developed the positive-electrode electrode and the negative-electrode electrode, and drawing 6 (B) is drawing showing some cross sections in the condition of having wound. Although the positive-active-material layer 32 is formed on the positive-electrode charge collector 31 at the positive-electrode electrode 3, the positive-electrode electrode tab connection 33 in which the positive-active-material layer 32 is not formed is formed on the positive-electrode charge collector 31, and the positive-electrode electrode tab 10 is joined by the positive-electrode electrode tab connection 33. On the other hand, although the negative-electrode active material layer 42 is formed on the negative-electrode charge collector 41 at the negative-electrode electrode 4, on the negative-electrode charge collector, the negative-electrode electrode tab connection 43 in which the negative-electrode active material layer 42 is not formed is formed, and the negative-electrode electrode tab 8 is joined by the negative-electrode electrode tab connection 43.

[0025] As for the thickness of the part which made thickness of the part which joined the positive-electrode electrode tab the same thickness as a positive-active-material layer, and joined the negative-electrode electrode tab, in this cell element, it is desirable that consider as the same thickness as a negative-electrode active material layer, and a positive-electrode electrode and a negative-electrode electrode consider as uniform thickness substantially. By winding using such a positive-electrode electrode and a negative-electrode electrode, and producing a cell element, a cell element with a uniform distance between a positive electrode and a negative electrode is producible.

[0026] Moreover, compared with the approach which actuation of the clearance after intermittent spreading of an electrode active material or spreading etc. was needed, and was shown in drawing 5 in order to establish the connection place of an electrode tab while becoming advantageous in order for the dependability of connection of an electrode tab to become high and to pass especially a high current since connection area of an electrode and an electrode tab was enlarged at the electrode shown in drawing 6, the productivity at the time of an electrode spreading process becomes low.

[0027] Moreover, as long as it arranges a positive-electrode electrode and a negative-electrode electrode so that all the projection sections to the negative-electrode electrode of the active material layer of a positive-electrode electrode may be contained in a negative-electrode active material layer besides the combination shown in drawing 5 or drawing 6 and the whole surface of a positive-active-material layer may moreover counter a negative-electrode active material layer, what combined the positive-electrode electrode shown in the negative-electrode electrode shown in drawing 5 and drawing 6 is sufficient as them.

[0028] Next, the manufacture approach of the nonaqueous electrolyte rechargeable battery of this invention is explained in order.

(1) Produce winding and a cell element for the layered product which produced the part which removed positive active material and a negative-electrode active material, joined the positive-electrode electrode tab and the negative-electrode electrode tab, and carried out the laminating through the separator from a band-like positive-electrode electrode and a band-like band-like negative-electrode electrode.

(2) Attach a positive-electrode side electric insulating plate and a negative-electrode side electric insulating plate in the end face of a cell element, and make a positive-electrode electrode tab and a negative-electrode electrode tab project from opening of both electric insulating plates.

[0029] (3) Arrange an electrode tab unification member to one of end faces at least, and a positive-electrode electrode tab or a negative-electrode electrode tab fixes a positive-electrode electrode tab or a negative-electrode electrode tab with an electrode tab unification member by the electrode tab fixing member, after [by the side of the positive electrode of a cell element, or a negative electrode] the electrode tab unification member has contacted.

(4) Hold a cell element in a cell can, weld the electric conduction tab of the pars basilaris ossis occipitalis of a can to the can bottom section, and form conductive connection.

(5) Carry out grooving (recessing) of the upper part of a cell can from the exterior, form the level difference section in the wall of a cell, and fix an insulating lid to the upper

part of a cell can.

[0030] (6) Join the electric conduction lead attached in the electrode tab unification member to the connection of a cell header by welding.

(7) Caulk a cell header through a gasket and close a cell, after pouring in the electrolytic solution.

In addition, although the above explanation described the example which a cell can connects conductively to a negative-electrode charge collector, the cell can which used aluminum etc. as the cell can may serve as a positive electrode, and the above positive electrode and negative electrode in explanation serve as reverse in this case.

[0031]

[Effect of the Invention] In the cell which attached two or more electrode tabs in the positive-electrode charge collector and negative-electrode charge collector of a winding object of a cell element the die length of an electrode tab is arranged -- having -- moreover -- the die length of an electrode tab, since equalization can realize the current which it is easy for loss by the electrode tab to decrease and to carry out arrangement of an electrode tab at equal intervals by shortening, and is impressed to each electric conduction tab Generation of heat by the energization current of some electric conduction tabs can be prevented. Moreover, since it can unify and two or more electrode tabs can be packed, without welding, a production process can be simplified.

[Brief Description of the Drawings]

[Drawing 1] Drawing 1 is a sectional view explaining one example of the cell of this invention.

[Drawing 2] Drawing 2 is drawing explaining one example which unifies the electrode tab by the electrode tab unification member, and is fixed.

[Drawing 3] Drawing 3 is drawing explaining an example besides unifying the electrode tab by the electrode tab unification member, and fixing.

[Drawing 4] Drawing 4 is drawing explaining other examples which unify the electrode tab by the electrode tab unification member, and are fixed.

[Drawing 5] Drawing 5 is drawing explaining an example of the cell element of this invention.

[Drawing 6] Drawing 6 is drawing explaining other examples of the cell element of this invention.

[Drawing 7] Drawing 7 is a sectional view explaining the conventional cylindrical cell.

[Description of Notations]

1 -- Nonaqueous electrolyte rechargeable battery

2 -- Cell can

3 -- Positive-electrode electrode
4 -- Negative-electrode electrode
5 -- Separator
6 -- Cell element
7 -- Negative-electrode side electric insulating plate
8 -- Negative-electrode electrode tab
9 -- Positive-electrode side electric insulating plate
10 -- Positive-electrode electrode tab
11 -- Electrode tab unification member
12 -- Fixing member
13 -- Insulating lid
14 -- Level difference section
15 -- Electric conduction lead
16 -- Cell header
17 -- Conductive connection section
18 -- Pressure disconnection plate
19 -- Gasket
20 -- Crevice
21 -- Heights
22 -- Omission prevention projection
23 -- Plate-like electric conduction contact-carrying member
24 -- Shaft
25 -- Thrust
26 -- Opening
27 28 -- Partition member
29 -- Omission prevention piece
31 -- Positive-electrode charge collector
32 -- Positive-active-material layer
33 -- Positive-electrode electrode tab connection
41 -- Negative-electrode charge collector
42 -- Negative-electrode active material layer
43 -- Negative-electrode electrode tab connection
51 -- Cylindrical cell
52 -- Cell can
53 -- Band-like negative electrode
54 -- Band-like positive electrode

- 55 -- Separator
- 56 -- Cell element
- 57 -- Negative-electrode lateral electrode tab
- 58 -- Positive-electrode lateral electrode tab
- 59 -- Cell header

(19) 日本国特許庁 (J P)

(12) 公開特許公報 (A)

(11) 特許出願公開番号

特開2001-6653

(P2001-6653A)

(43) 公開日 平成13年1月12日 (2001. 1. 12)

(51) Int.Cl.⁷

識別記号

F I

テ-コ-ド* (参考)

H 0 1 M 2/26
10/40

H 0 1 M 2/26
10/40

A 5 H 0 2 2
Z 5 H 0 2 9

審査請求 有 請求項の数 4 O L (全 8 頁)

(21) 出願番号 特願平11-179672

(22) 出願日 平成11年6月25日 (1999. 6. 25)

(71) 出願人 000004237

日本電気株式会社

東京都港区芝五丁目7番1号

(72) 発明者 北見 剛

東京都港区芝五丁目7番1号 日本電気株式会社内

(72) 発明者 座間 浩一

東京都港区芝五丁目7番1号 日本電気株式会社内

(74) 代理人 100091971

弁理士 米澤 明

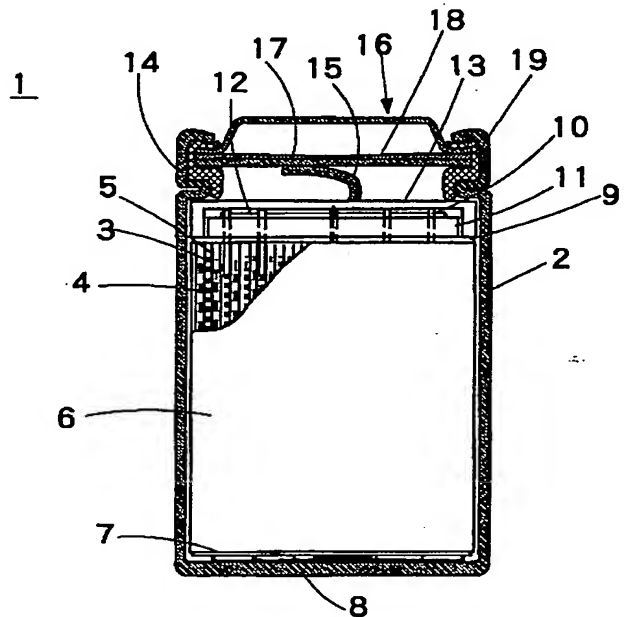
最終頁に続く

(54) 【発明の名称】 非水電解液二次電池

(57) 【要約】

【目的】 円筒形電池の集電構造を改良することにより、I R 損失が少なく高率放電特性の電池の製造を簡素化する。

【構成】 正極電極と負極電極をセパレータを介して積層したものを巻回した電池要素の端面の近傍の少なくとも一方に電極タブ一体化部材を設け、電池要素の端面から延びた正極集電体あるいは負極集電体の少なくともいずれか一方に接続した複数の電極タブが、電極タブ一体化部材の導電性面に接した状態で、電極タブ固着部材を電極タブ一体化部材に嵌合するか、あるいは電極タブ一体化部材の構成部材を変形し、溶接することなく電極タブを電極タブ一体化部材に固着するとともに、電極タブ一体化部材あるいは電極タブ固着部材と電池の外部接続端子を導電接続リードにより接合した非水電解液二次電池。



1

【特許請求の範囲】

【請求項1】 正極集電体と負極集電体のそれぞれに正極活物質層、負極活物質層を形成してセパレータを介して積層したものを巻回した電池要素を電池缶に収容した非水電解液二次電池において、電池要素の端面の近傍の少なくとも一方に電極タブ一体化部材を設け、電池要素の端面から延びた正極集電体あるいは負極集電体の少なくともいずれか一方に接続した複数の電極タブが、電極タブ一体化部材の導電性面に接した状態で、電極タブ固着部材を電極タブ一体化部材に嵌合するか、あるいは電極タブ一体化部材の構成部材を変形し、電極タブを電極タブ一体化部材に固着するとともに、電極タブ一体化部材あるいは電極タブ固着部材と電池の外部接続端子を導電接続リードにより接合したことを特徴とする非水電解液二次電池。

【請求項2】 電極タブ一体化部材が、内面に電極タブとの接触面を有するテーパ状管状体であり、テーパ状管状体の内面には、凹部が形成されており、固着部材に設けた凸部によって変形した電極タブを凹部によって保持したものであることを特徴とする請求項1記載の非水電解液二次電池。

【請求項3】 電極タブ一体化部材が、軸に結合して対向して配置した平板状体であり、対向して配置した平板状体の間に電極タブを配置して平板状体を変形させて固定したものであることを特徴とする請求項1記載の非水電解液二次電池。

【請求項4】 平板状体の電極タブとの接触面に、電極タブを変形して保持する凹部あるいは凸部の少なくともいずれか一方が形成されていることを特徴とする請求項3記載の非水電解液二次電池。

【発明の詳細な説明】

【0001】

【産業上の利用分野】 本発明は、非水電解液を用いた二次電池に関するものであり、とくに高率充放電が可能な非水電解液二次電池に関するものである。

【0002】

【従来の技術】 リチウムをドーブ、脱ドーブすることができる負極と遷移金属酸化物を含有する正極を用いたリチウムイオン二次電池に代表される非水電解液二次電池は、帯状の負極側集電体に負極活物質を塗布した帯状負極と、帯状の正極側集電体に正極活物質を塗布した帯状正極とをセパレータを介して積層したものを外装材で被覆するか、あるいはこれらの積層したものを、渦巻状に巻回して円筒状のジェリーロールと称される電池要素を作製した後に、電池缶内に収容して電池とすることが行われている。

【0003】 とくに円筒状の電池要素を電池缶内に収容した電池は、密閉性に優れると共に円筒状であるために、積層体の部位によらず一様な電池反応を行うことが可能であるという特徴を有しており、大電流を取り出す

2

目的で使用される非水電解液二次電池においても円筒型の電池が重要な位置を占めており、電気自動車、電気補助自転車用等の動力用の大型電池としても期待されている。

【0004】 図7は、従来の円筒型の電池を説明する断面図である。円筒型の電池51は、電池缶52内に、負極側集電体に負極活物質を設けた帯状負極53と正極側集電体に正極活物質を設けた帯状正極54を帯状負極および帯状正極よりも幅が大きなセパレータ55を介して積層したものを巻回した電池要素56が設けられており、電池要素の両端面には、正極あるいは負極は突出せずセパレータの端面で構成されている。電池缶52を負極側端子とした電池の場合には、帯状負極に取り付けた短冊状の負極側電極タブ57を溶接等の方法によって電池缶の内壁に接合している。また、正極側電極タブ58は、電池内部の異常な圧力上昇時に内部の圧力を開放する圧力開放弁等を有した、正極側端子を兼ねた電池ヘッダー59に接続されている。

【0005】 ところが、このような電池においては、短冊状の電極タブが長くなり、電極タブ部での損失が大きくなり、また複数の電極リード長を揃えることができないので、電極タブ間での電流の損失が不均一となり一部の電極タブが通電電流で発熱するという問題があり、高率放電ができないという問題があった。

【0006】

【発明が解決しようとする課題】 そこで、高率放電によるIR損失を低下させるために、電池缶内部の電池要素の巻回体の端面に、大きく広がったショルダー部を設けて、巻回体の帯状集電体から多数の導電リブを取り出して接続することによって少数の導電リブの取り出しによるIR損失を改善した円筒型電池が、特開平10-83805号公報において提案されている。

【0007】 しかしながら、このような電池においては、複数の導電リブを用いることによってIR損失を改善することができるものの、電池要素上に導電リブを接続するためのショルダー部を電池缶内に設けることが必要となり、電池缶内部の無効な容積が増加し、大きな容量密度を有するという非水電解液二次電池の特徴を減ずることとなるとともに、多数の導電リブを電池要素の端面に設けたショルダー部に溶接する工程は、多くの作業工数を必要とし組立工程が複雑なものとなる。本発明は、高率放電時の電池要素と電池缶あるいは電池蓋体との間の電極タブによるIR損失を低下させた、容量密度が大きく組み立てが容易な非水電解液二次電池を提供することを課題とするものである。

【0008】

【課題を解決するための手段】 本発明は、正極集電体と負極集電体のそれぞれに正極活物質層、負極活物質層を形成してセパレータを介して積層したものを巻回した電池要素を電池缶に収容した非水電解液二次電池において、

50

3

電池要素の端面の近傍の少なくとも一方に電極タブ一体化部材を設け、電池要素の端面から延びた正極集電体あるいは負極集電体の少なくともいずれか一方に接続した複数の電極タブが、電極タブ一体化部材の導電性面に接した状態で、電極タブ固着部材を電極タブ一体化部材に嵌合するか、あるいは電極タブ一体化部材の構成部材を変形し、電極タブを電極タブ一体化部材に固着するとともに、電極タブ一体化部材あるいは電極タブ固着部材と電池の外部接続端子を導電接続リードにより接合した非水電解液二次電池である。

【0009】電極タブ一体化部材が、内面に電極タブとの接触面を有するテーバ状管状体であり、テーバ状管状体の内面には、凹部が形成されており、固着部材に設けた凸部によって変形した電極タブを凹部によって保持したものである前記の非水電解液二次電池である。電極タブ一体化部材が、軸に結合して対向して配置した平板状体であり、対向して配置した平板状体の間に電極タブを配置して平板状体を変形させて固定したものである前記の非水電解液二次電池である。平板状体の電極タブとの接触面に、電極タブを変形して保持する凹部あるいは凸部の少なくともいずれか一方が形成されている前記の非水電解液二次電池である。

【0010】

【発明の実施の形態】本発明は、帯状の正極電極および帯状の負極電極をセパレータを介して積層したものを巻回した電池要素の端面の近傍の少なくとも一方に電極タブ一体化部材を設け、電池要素の端面から延びた正極集電体、負極集電体に接続した複数の電極タブを電極タブ一体化部材の導電接触面において接触させて、電極タブ一体化部材に嵌合した固着部材によって固着して固定したものである。そして、これによって電極タブ部での損失を低減し、また複数の電極タブ長を揃えることができ、電極タブ間での損失が均一化し、電流による部分的な発熱を防止することができ、また複数の電極タブを溶接する工程を不要とし組立工程を簡素化を可能としたものである。

【0011】以下に、図面を参照して本発明を説明する。図1は、本発明の電池の一実施例を説明する断面図である。本発明の非水電解液二次電池1は、正極集電体上に正極活物質層を形成した正極電極3と、負極集電体上に負極活物質層を形成した負極電極4とをセパレータ5を介して積層したものを巻回した電池要素6を電池缶2内部に収容している。電池要素6の底部の端面には、負極側絶縁板7が設けられており、負極集電体の端部に取り付けられた複数の負極電極タブ8が負極側絶縁板の開口部から延びており、それらの複数の負極電極タブは、電池缶2の内面に接合されている。

【0012】また、電池要素6の上部の端面には、正極側絶縁板9が設けられており、電池要素の正極集電体の端部に取り付けられた複数の正極電極タブ10が、正極

4

側絶縁板に設けた開口部から延びて電極タブ一体化部材11の内面に接触した状態で、電極タブ一体化部材11の内部に嵌合した固着部材12によって固定されている。電極タブ一体化部材11の上部には、絶縁性蓋体13が取り付けられており、絶縁性蓋体13は、電池缶2の溝加工によって形成した段差部14によって固定され、電池要素6の電池缶内部での移動を防止している。また、電極タブ一体化部材11には、導電リード15が接続されており、外部接続端子を兼ねた電池ヘッダー16の導電接続部17に接合されて導電接続を形成している。導電リードとして带状等の金属部材に代えて弾性を有する部材を用いても良く、弾性を有する部材を用いることによって電池要素を電池ヘッダーとの間でバネによって保持することができるので、電池に対して外部から加わる衝撃を緩和することが可能となる。

【0013】電池ヘッダー16には、電池内部の異常による内部圧力の上昇時に作動する圧力開放板18や、過大な電流を遮断する素子等が設けられていても良い。また、電池ヘッダー16は、電池缶2の段差部14に取り付けたガスケット19を介して電池缶2の上部をかしめることによって電池を封口している。

【0014】図2は、電極タブ一体化部材による電極タブを一体化して固定する一実施例を説明する図である。図2(A)は斜視図を示し、図2(B)は取り付けた状態を説明する断面図である。電極タブ一体化部材11は、内面は上部の径が下部の径よりも大きなテーバ状の曲面が形成されており、複数の正極電極タブ10が内面に接触した状態で、電極タブ一体化部材11の内部に固着部材12が上部より圧入されて、電極タブ一体化部材と嵌合されて、正極電極タブ10が固定される。なお、図面では、正極タブは2個のみを図示したが、正極電極タブの数は電池要素の電極面積等に応じて任意の個数を用いることができる。

【0015】電極タブ一体化部材11の内面には、複数の凹部20が形成されており、上部から圧入した固着部材12の表面に設けた凸部21によって変形した正極導電タブ10が凹部20において保持されて、導電接続がより確実なものとされる。また、電極タブ一体化部材および固着部材をそれぞれテーバ状の曲面とすることによって、凸部の挿入を円滑に行うことができる。凹部、凸部は、頂部を切断した多角錐型、半球面形等の形状等とし、両者の接触面を大きくすることが好ましい。また、凸部は、固着部材の電極タブ一体化部材との接触面の幅方向に複数個を設けても良く、図に示した例では、幅方向に3個ずつ形成するとともに、周面の全体に設けている。周面の全面に凹凸を設けることによって、巻回体の端面に取り出された正極電極タブの位置に係わらず任意の位置で正極電極タブを電極タブ一体化部材に結合することができる。

【0016】また、固着部材12には、脱落防止突起2

50

5

2を設けることによって、圧入された固着部材が上部へ移動することを防止することができる。脱落防止突起22は、円周上に3カ所以上設けることが好ましい。また、電極タブ一体化部材11には、電極タブ一体化部材と電池ヘッダーの導電接続部を接続する導電リード15があらかじめ取り付けられていても良く、電極タブ一体化部材11を作製する際に導電リードを一体に作製することによって導電リードを接合する工程が不要となり製造工程が減少するので好ましい。

【0017】図3は、電極タブ一体化部材による電極タブを一体化して固定する他の例を説明する図である。図3(A)は斜視図を示し、図3(B)は取り付けた状態を説明する断面図である。図3は、平板状導電接触部材23を軸24によって間隔を保持して結合した電極タブ一体化部材11を示す図であり、平板状導電接触部材23の間の空間に複数個の正極電極タブ10を矢印方向に挿入し、平板状導電接触部材の両面から押圧力25を加えて押し潰すことによって電極タブ一体化部材11と正極電極タブ10を一体化したものである。

【0018】平板状導電接触部材23の正極電極タブとの接触面の一方には、複数の凹部20が形成されており、対向する他方の平板状導電接触部材の接触面には、複数の凸部21が形成されており、上下の平板状導電接触部材23を押圧によって押し潰す際に上下の平板状導電接触部材の凹凸形状により正極電極タブ10が変形して電極リードタブの両面に凹凸が形成されるので電極タブ一体化部材11から抜け落ちることなく確実に固着される。なお、図面では、正極タブは2個のみを図示したが、正極電極タブの数は電池の容量等によって任意の個数を用いることができる。また、電極タブ一体化部材11には、電極タブ一体化部材と電池ヘッダーの導電接続部を導電接続する導電リード15があらかじめ取り付けられていても良い。

【0019】図4は、電極タブ一体化部材による電極タブを一体化して固定する他の例を説明する図である。図4(A)は斜視図を示し、図4(B)は取り付けた状態を説明する断面図である。電極タブ一体化部材11は、内部に開口部26を有した円盤状の部材から構成されており、開口部26の導電接触面には複数個の正極電極タブ10が内面に接触した状態で、上部から内部に電極タブ一体化部材11の直径に合致した凹部を形成した固着部材12が上部より圧入されて、電極タブ一体化部材11と嵌合されて正極電極タブ10が固定される。なお、図面では、正極タブは2個のみを図示したが、正極電極タブの数は電池の容量等によって任意に定めることができる。また、電極タブ一体化部材11には、電極タブ一体化部材11の開口部26には、区画部材27を設けて複数の区画が形成されており、区画部材27によって正極電極タブ10の取り付け位置を所定の位置を容易に定めることができる。

6

【0020】電極タブ一体化部材11の外面には、複数の凸部21が形成されており、上部から圧入した固着部材12の内面に設けた凹部20との間で正極電極タブ10が凹部20と凸部21の間で保持されて、導電接続がより確実なものとされる。また、固着部材12には、電極タブ一体化部材11に設けたものと同様の区画部材28によって複数の開口部が設けられている。さらに固着部材12には脱落防止片29を設け、固着部材を電極タブ一体化部材とを固着した後に、脱落防止片29を折り曲げることによって固着部材の脱落を防止することができる。脱落防止片は、円周上に3カ所以上設けることが好ましい。また、電極タブ固着部材12には、電極タブ一体化部材と電池ヘッダーの導電接続部を導電接続する導電リード15があらかじめ取り付けられていても良い。

【0021】本発明の電極タブ一体化部材は、充放電時の電池内部の環境において安定な金属を用いることが好ましく、正極側にあつては、アルミニウム、チタンおよびその合金が用いられる。また、形成した凹凸部において、正極電極タブとして用いるアルミニウム箔材を確実に変形して保持することができるように硬度が大きな部材を用いることが好ましい。同様に、電極タブ一体化部材が負極側に用いられる場合には、ニッケルおよびその合金、ステンレス等が用いられ、負極電極タブとして用いられるニッケル箔が固着時に形成される凹凸によって確実に固着できるように、硬度の大きな部材が用いられる。

【0022】また、電極タブ一体化部材は、電池の動作電流に応じて適宜、その大きさ等を定めることができるが、例えば、最大で100Aの充放電を行う電池においては、電極タブ一体化部材は、電流通過部の断面積を3mm²以上とすることによって過大な発熱等を防止して安定した電池を得ることができる。また、電極タブ一体化部材から電池ヘッダー等の外部接続端子に接続する導電リードも同様に3mm²以上の断面積を有するものとすることが好ましく、電極タブ一体化部材と正極電極タブあるいは負極電極タブとの接触部の合計面積も3mm²以上とすることが好ましい。

【0023】本発明の電池に用いる正極電極および負極電極について説明する。図5は、本発明の電池要素の一例を説明する図であり、図5(A)は、正極電極および負極電極を展開した平面図であり、図5(B)は、巻回した状態の一部の断面を示す図である。正極電極3は、正極集電体31上に正極活物質層32を形成したものであり、正極集電体31の端部の正極活物質層が形成されていない部分に正極電極タブ10が接合されている。負極電極4には、負極集電体41上に負極活物質層42が形成されており、負極集電体41の端部の負極活物質層42が形成されていない部分に負極電極タブ8が接合されている。また、図5に示した正極電極あるいは負極電

7

極は、一つの電極が連続しているので電極塗布工程の生産性が高く、電極に取り付ける電極タブの幅、接続位置の制限を受けず、巻回時の電極タブの位置合わせも容易である。

【0024】図6は、本発明の電池要素の他の例を説明する図であり、図6（A）は、正極電極および負極電極を展開した平面図であり、図6（B）は、巻回した状態の一部の断面を示す図である。正極電極3には正極集電体31上に正極活物質層32が形成されているが、正極集電体31上に、正極活物質層32が形成されていない正極電極タブ接続部33が形成されており、正極電極タブ接続部33には、正極電極タブ10が接合されている。一方、負極電極4には、負極集電体41上に負極活物質層42が形成されているが、負極集電体41上に、負極活物質層42が形成されていない負極電極タブ接続部43が形成されており、負極電極タブ接続部43に負極電極タブ8が接合されている。

【0025】この電池要素においては、正極電極タブを接合した部分の厚さは正極活物質層と同じ厚さとし、また負極電極タブを接合した部分の厚さは負極活物質層と同じ厚さとし、実質的に正極電極および負極電極が一樣な厚さとすることが好ましい。このような正極電極および負極電極を用いて巻回して電池要素を作製することによって、正極および負極間の距離が均一な電池要素を作製することができる。

【0026】また、図6に示した電極には、電極と電極タブとの接続面積を大きくすることができるので、電極タブの接続の信頼性が高くなり、特に大電流を流すためには有利となる反面、電極タブの接続箇所を設けるために電極活物質の間欠塗布、あるいは塗布後の除去等の操作が必要となり図5に示した方法に比べて電極塗布工程時の生産性が低くなる。

【0027】また、正極電極と負極電極は、図5あるいは図6に示す組合せ以外にも、正極電極の活物質層の負極電極への投影部が全て負極活物質層に含まれ、しかも正極活物質層の全面が負極活物質層に対向するように配置すれば、図5に示す負極電極と図6に示す正極電極を組み合わせただけのもでも良い。

【0028】次に、本発明の非水電解液二次電池の製造方法を順に説明する。

（1）帯状の正極電極および帯状の負極電極から、正極活物質および負極活物質を取り除いた部分を作製して正極電極タブおよび負極電極タブを接合してセパレータを介して積層した積層体を巻回し、電池要素を作製する。

（2）電池要素の端面に正極側絶縁板および負極側絶縁板を取り付けて、両絶縁板の開口部から正極電極タブおよび負極電極タブを突出させる。

【0029】（3）電池要素の正極側あるいは負極側の少なくともいずれかの端面に電極タブ一体化部材を配置して、正極電極タブあるいは負極電極タブが電極タブ一

8

体化部材の接触した状態で、電極タブ固着部材によって正極電極タブあるいは負極電極タブを電極タブ一体化部材と固着する。

（4）電池缶に電池要素を収容して、缶の底部の導電タブを缶底部に溶接して導電接続を形成する。

（5）電池缶の上部を外部よりグルーピング（溝加工）し、電池の内壁に段差部を形成して電池缶の上部に絶縁性蓋体を固定する。

【0030】（6）電極タブ一体化部材に取り付けた導電リードを電池ヘッダーの接続部に溶接によって接合する。

（7）電解液を注入した後に電池ヘッダーをガスケットを介してかしめ加工して電池を封止する。

なお、以上の説明では、電池缶が負極集電体と導電接続する例について述べたが、アルミニウム等を電池缶とした電池缶が正極となるものであっても良く、この場合には、以上の説明における正極と負極が逆となる。

【0031】

【発明の効果】電池要素の巻回体の正極集電体および負極集電体に複数の電極タブを取り付けた電池において、電極タブの長さを揃えられて、しかも電極タブの長さ短くすることによって電極タブによる損失が低減し、また、電極タブの配置を等間隔にすることが容易であり、各導電タブに印加される電流を均一化が実現できるので、一部の導電タブの通電電流による発熱を防止することができる。また、複数の電極タブを溶接を行うことなく一体化してまとめることができるので、製造工程を簡素化することができる。

【図面の簡単な説明】

【図1】図1は、本発明の電池の一実施例を説明する断面図である。

【図2】図2は、電極タブ一体化部材による電極タブを一体化して固定する一実施例を説明する図である。

【図3】図3は、電極タブ一体化部材による電極タブを一体化して固定する他の実施例を説明する図である。

【図4】図4は、電極タブ一体化部材による電極タブを一体化して固定する他の実施例を説明する図である。

【図5】図5は、本発明の電池要素の一例を説明する図である。

【図6】図6は、本発明の電池要素の他の例を説明する図である。

【図7】図7は、従来の円筒型の電池を説明する断面図である。

【符号の説明】

1…非水電解液二次電池

2…電池缶

3…正極電極

4…負極電極

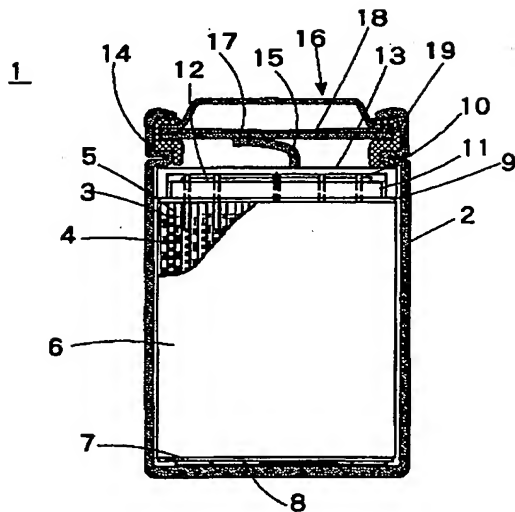
5…セパレータ

6…電池要素

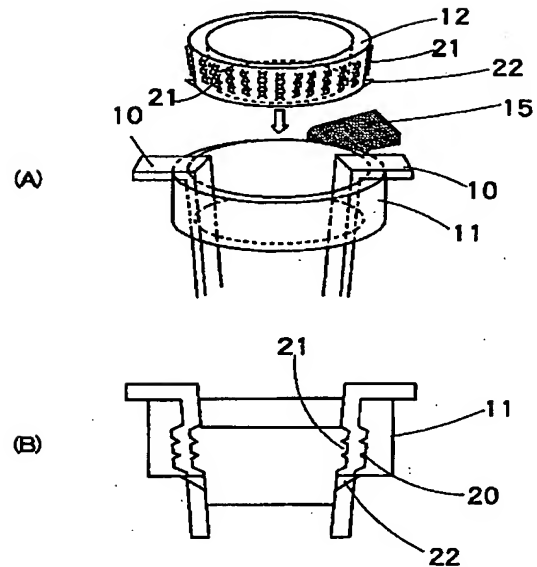
7…負極側絶縁板
 8…負極電極タブ
 9…正極側絶縁板
 10…正極電極タブ
 11…電極タブ一体化部材
 12…固着部材
 13…絶縁性蓋体
 14…段差部
 15…導電リード
 16…電池ヘッダー
 17…導電接続部
 18…圧力開放板
 19…ガasket
 20…凹部
 21…凸部
 22…脱落防止突起
 23…平板状導電接触部材
 24…軸
 25…押圧力

26…開口部
 27, 28…区画部材
 29…脱落防止片
 31…正極集電体
 32…正極活物質層
 33…正極電極タブ接続部
 41…負極集電体
 42…負極活物質層
 43…負極電極タブ接続部
 10 51…円筒型の電池
 52…電池缶
 53…帯状負極
 54…帯状正極
 55…セパレータ
 56…電池要素
 57…負極側電極タブ
 58…正極側電極タブ
 59…電池ヘッダー

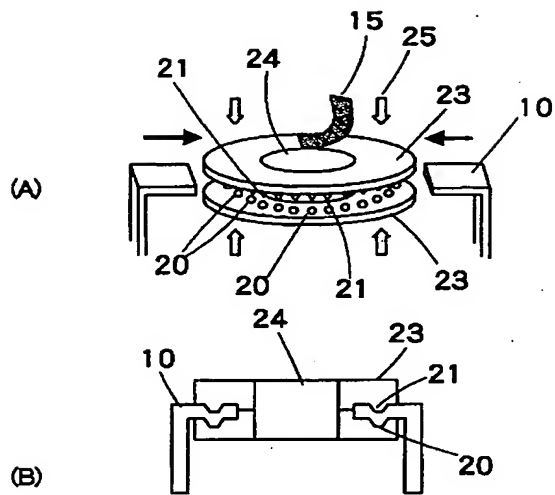
【図1】



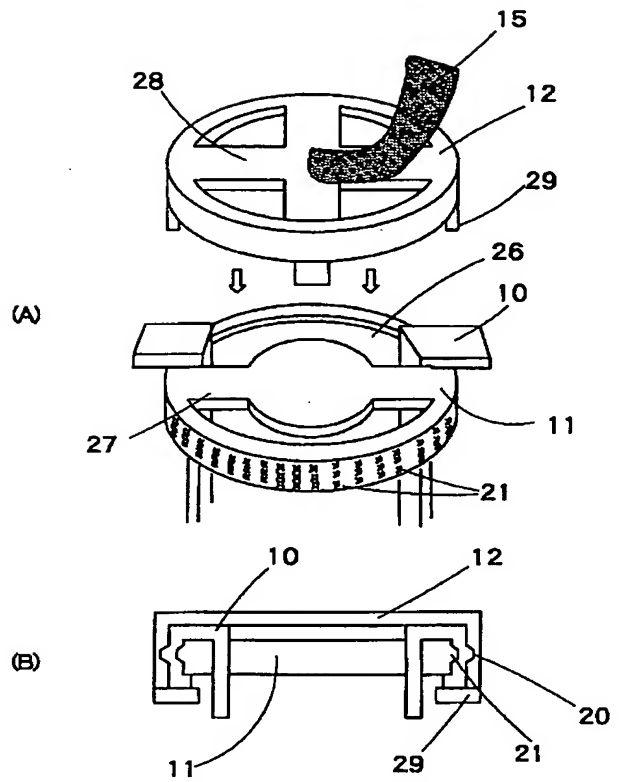
【図2】



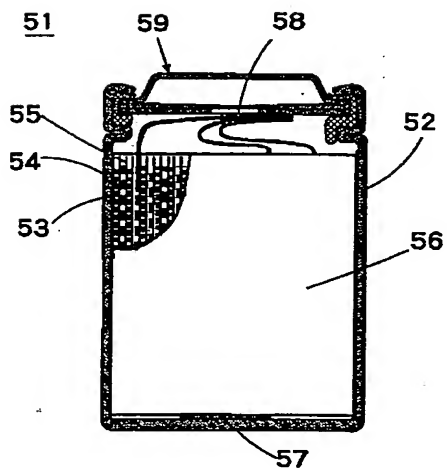
【図3】



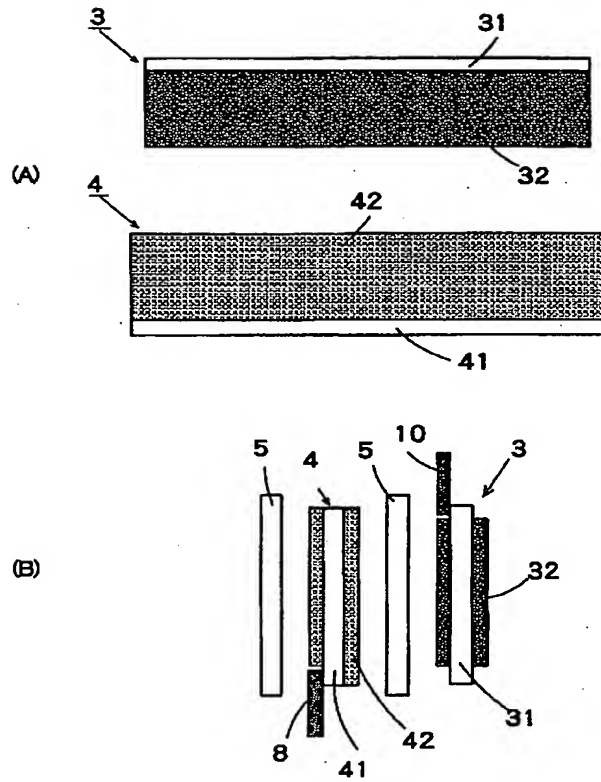
【図4】



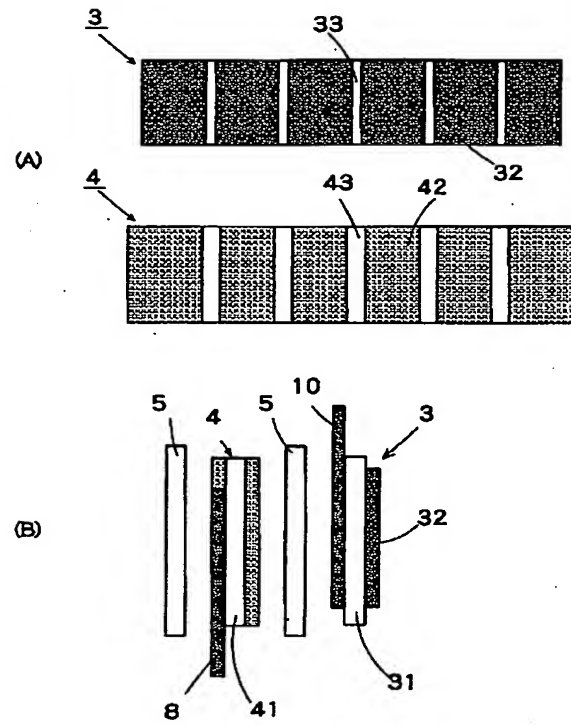
【図7】



【図5】



【図6】



フロントページの続き

Fターム(参考) 5H022 AA09 AA18 BB03 CC08 CC12
CC16 CC19
5H029 AJ06 AJ14 BJ02 BJ14 CJ05
DJ05 DJ07